

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
4 September 2003 (04.09.2003)

PCT

(10) International Publication Number
WO 03/073517 A1

(51) International Patent Classification⁷: **H01L 31/042**,
23/58, H05B 33/00

(21) International Application Number: PCT/US02/05781

(22) International Filing Date: 27 February 2002 (27.02.2002)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicant (for all designated States except US): **MIDWEST RESEARCH INSTITUTE [US/US]**; 425 Volker Boulevard, Kansas City, CO 64110 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **WANLASS, Mark, W.** [US/US]; 2104 Douglas Mountain Road, Golden, CO 80403 (US). **MASCARENHAS, Angelo** [US/US]; 2285 South Holman Circle, Lakewood, CO 80228 (US).

(74) Agents: **WHITE, Paul, J.** et al.; National Renewable Energy Laboratory, 1617 Cole Boulevard, Golden, CO 80401 (US).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

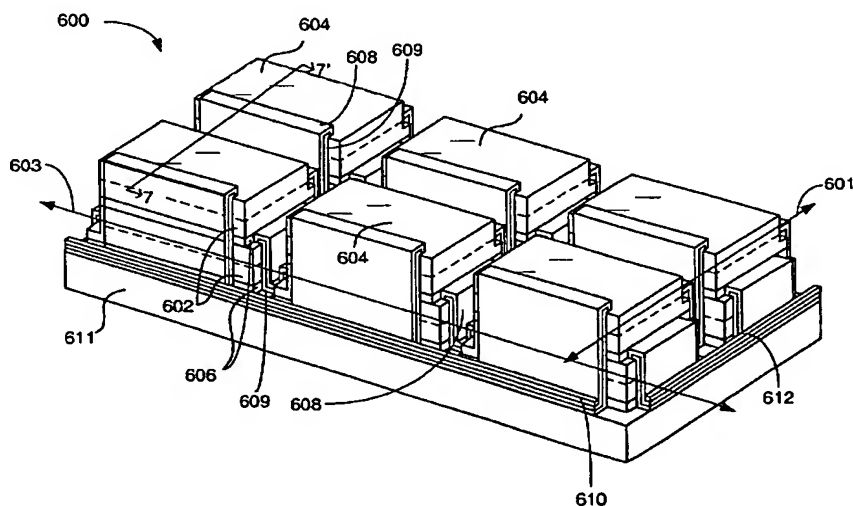
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to the identity of the inventor (Rule 4.17(i)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT,

[Continued on next page]

(54) Title: **MONOLITHIC PHOTOVOLTAIC ENERGY CONVERSION DEVICE**



(57) Abstract: A multi-junction, monolithic, photovoltaic (PV) cell and device (600) is provided for converting radiant energy to photocurrent and photovoltage with improved efficiency. The PV cell includes an array of subcells (602), i.e., active p/n junctions, grown on a compliant substrate, where the compliant substrate accommodates greater flexibility in matching lattice constants to adjacent semiconductor material. The lattice matched semiconductor materials are selected with appropriate band-gaps to efficiently create photovoltage from a larger portion of the solar spectrum. Subcell strings (601, 603) from multiple PV cells are voltage matched to provide high output PV devices. A light emitting cell and device is also provided having monolithically grown red-yellow and green emission subcells and a mechanically stacked blue emission subcell.



WO 03/073517 A1



LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

— of inventorship (Rule 4.17(iv)) for US only

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.